

I claim:

1. A thermal management system for a battery including a plurality of cells, comprising:

5 at least one duct contacting an outer wall of each of said cells adapted to allow a liquid medium to flow therethrough.

10 2. A thermal management system according to claim 1, wherein said liquid medium is thermally conductive.

15 3. A thermal management system according to claim 1, wherein said at least one duct is made from a thermally conductive material.

4. A thermal management system according to claim 1, further comprising a 15 thermally conductive medium positioned between said at least one duct and said cells where said duct contacts said cells.

5. A thermal management system according to claim 1, wherein said duct has an 20 inlet manifold to allow said liquid to flow into said duct, and an exit manifold to allow said liquid to flow out of said duct.

6. A thermal management system according to claim 1, further comprising a heating and cooling apparatus to heat or cool said liquid.

7. A thermal management system according to claim 1, further comprising a pump which causes said liquid to flow through said duct.

8. A thermal management system according to claim 7, wherein said pump 5 includes a heating and cooling apparatus to heat or cool said liquid.

9. A thermal management system according to claim 1, wherein said at least one duct has a rectangular cross-section.

10. A thermal management system according to claim 1, wherein said at least one duct is at least partially wrapped around each of said cells.

11. A thermal management system for a battery including a plurality of cells, comprising:  
15 at least one thermal jacket for receiving a liquid thermal medium; wherein said at least one thermal jacket is located between and contacts adjacent one of said cells.

12. A thermal management system according to claim 11, wherein said liquid 20 medium is thermally conductive.

13. A thermal management system according to claim 11, wherein said at least one thermal jacket is made from a thermally conductive material.

14. A thermal management system according to claim 11, further comprising a thermally conductive medium positioned between said at least one thermal jacket and said cells where said thermal jacket contacts said cells.

5 15. A thermal management system according to claim 11, wherein said at least one thermal jacket has an inlet manifold to allow said liquid to flow into said thermal jacket, and an exit manifold to allow said liquid to flow out of said thermal jacket.

10 16. A thermal management system according to claim 11, further comprising a heating and cooling apparatus to heat or cool said liquid.

15 17. A thermal management system according to claim 11, further comprising a pump which causes said liquid to flow through said at least one thermal jacket.

18. A thermal management system according to claim 17, wherein said pump includes a heating and cooling apparatus to heat or cool said liquid.

19. A thermal management system according to claim 11, wherein said at least one thermal jacket has a plurality of cell receiving portions shaped to fit at least some of an 20 outer surface of said cells.

20. A thermal management system according to claim 11, wherein said at least one thermal jacket has a rectangular cross-section.

21. A thermal management system according to claim 11, wherein said at least one thermal jacket is at least partially wrapped around each of said cells.

22. A thermal management system for a battery including a plurality of cells,  
5 comprising:  
a plurality of thermal jackets for receiving a liquid thermal medium;  
wherein each of said plurality of thermal jackets is located between adjacent ones of  
said cells.

10 23. A thermal management system according to claim 22, wherein said liquid medium is thermally conductive.

15 24. A thermal management system according to claim 22, wherein at least one of said plurality of thermal jackets is made from a thermally conductive material.

20 25. A thermal management system according to claim 22, further comprising a thermally conductive medium positioned between at least one of said plurality of thermal jackets and said cells where said at least one of said plurality of thermal jackets contacts said cells.

26. A thermal management system according to claim 22, wherein at least one of said plurality of thermal jackets has an inlet manifold to allow said liquid to flow into said at least one of said plurality of thermal jackets, and an exit manifold to allow said liquid to flow out of said at least one of said plurality of thermal jackets.

27. A thermal management system according to claim 22, further comprising a heating and cooling apparatus to heat or cool said liquid.

5 28. A thermal management system according to claim 22, further comprising a pump which causes said liquid to flow through said at least one thermal jacket.

10 29. A thermal management system according to claim 28, wherein said pump includes a heating and cooling apparatus to heat or cool said liquid.

15 30. A thermal management system according to claim 22, wherein at least one of said plurality of said thermal jackets has a plurality of cell receiving portions shaped to fit at least some of an outer surface of said cells.

20 31. A thermal management system according to claim 22, wherein at least one of said plurality of thermal jackets has a rectangular cross-section.

32. A thermal management system according to claim 22, wherein at least one of said plurality of thermal jackets has a changing cross-section throughout the length of said at least one thermal jacket.

33. A thermal management system according to claim 22, wherein each of said plurality of thermal jackets has an inlet manifold to allow said liquid to flow into each of said

plurality of thermal jackets, and an exit manifold to allow said liquid to flow out of each of said plurality of thermal jackets.

34. A thermal management system according to claim 22, further comprising a  
5 heating and cooling apparatus to which each of said plurality of said thermal jackets is  
connected.

35. A thermal management system according to claim 34, wherein each of said  
plurality of said thermal jackets is connected to the same heating and cooling apparatus to  
10 heat or cool said liquid.

36. A thermal management system according to claim 35, wherein each of said  
plurality of said thermal jackets is connected in parallel to said heating and cooling apparatus.

37. A thermal management system according to claim 35, wherein each of said  
plurality of said thermal jackets is connected in series to said heating and cooling apparatus.

38. A thermal management system according to claim 22, further comprising at  
least one pump, wherein each of said plurality of thermal jackets is connected to said at least  
20 one pump which causes said liquid to flow through said thermal jackets.

39. A thermal management system according to claim 38, wherein each of said  
plurality of thermal jackets is connected to the same pump which causes said liquid to flow  
through each of said thermal jackets.

40. A thermal management system according to claim 39, wherein each of said plurality of said thermal jackets is connected in parallel to said pump.

5 41. A thermal management system according to claim 39, wherein each of said plurality of said thermal jackets is connected in series to said pump.

10 42. A thermal management system according to claim 38, wherein said pump includes a heating and cooling apparatus to heat or cool said liquid.

15 43. A thermal management system according to claim 39, wherein said pump includes a heating and cooling apparatus to heat or cool said liquid.

20 44. A thermal management system according to claim 22, wherein each of said plurality of said thermal jackets has a plurality of cell receiving portions shaped to fit at least some of an outer surface of said cells.

25 45. A thermal management system according to claim 22, wherein each of said plurality of thermal jackets has a rectangular cross-section.

30 46. A thermal management system according to claim 22, wherein each of said plurality of thermal jackets has a changing cross-section throughout the length of said thermal jackets.

47. A method of thermally managing the temperature of a battery including a plurality of cells by thermally managing the temperature of said cells, comprising:  
passing at least one hollow tube among at least some of said cells so as to make contact with said at least some of said cells; and  
5 passing a liquid medium through said at least one hollow tube.

48. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, wherein said liquid medium is thermally conductive.

10 49. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, wherein said at least one hollow tube is made from a thermally conductive material.

15 50. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, further comprising placing a thermally conductive medium between said at least one hollow tube and said cells where said at least one hollow tube contacts said cells.

20 51. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, wherein said at least one hollow tube has an inlet manifold to allow said liquid to flow into said at least one hollow tube, and an exit manifold to allow said liquid to flow out of said at least one hollow tube.

52. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, further comprising heating said liquid in a heating apparatus connected to said at least one hollow tube.

5 53. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 52, wherein said heating of said liquid is prior to said liquid passing through said at least one hollow tube.

10 54. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 47, further comprising cooling said liquid in a cooling apparatus connected to said at least one hollow tube.

15 55. A method of thermally managing the temperature of a battery including a plurality of cells according to claim 54, wherein said cooling of said liquid is prior to said liquid passing through said at least one hollow tube.